



Hybrid triticales in Switzerland: past experience

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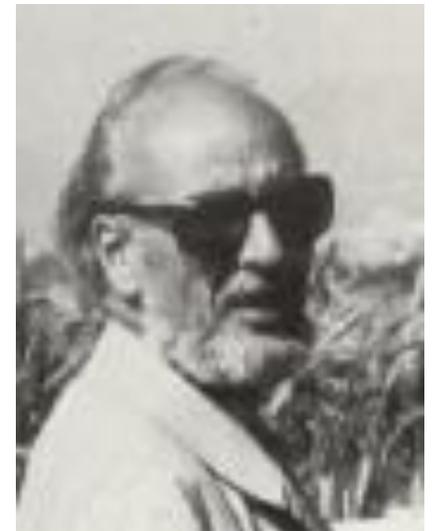


History of triticales breeding in Switzerland

(1)

AABBDDRR

- In the 50': first studies by E. Oehler (a German pioneer in triticales research) and M. Ingold.
- From the 50' to 1976: octoploid triticales breeding
- Main goal:
 - Spike fertility
- Chromosome number instability





History of triticales breeding Switzerland



AABBRR

- 1976: after Aldo Fossati visit INRA Clermont-Ferrand, switch to hexaploid triticales breeding
- Collaboration with
 - Poland (T. Wolski)
 - USA (R. Metzger, Kolding)
 - CIMMYT (G. Varughese, W. Pfeiffer)
 - EUCARPIA (ETYN Triticales yield nursery)
- France, INRA (Dr M. Bernard), Pool Triticales
- Cooperation with Claeys-Luck
→ Orsem → DuPont Hybrinova





Breeding goals

- Yield
 - Lodging resistance
 - Reducing plant height
- Grain filling
- Specific weight
- Disease resistance
 - Septoria
 - Yellow rust
 - Brown rust
 - Mildew



Hybrid triticale F1 | Gumpenstein
D. Fossati



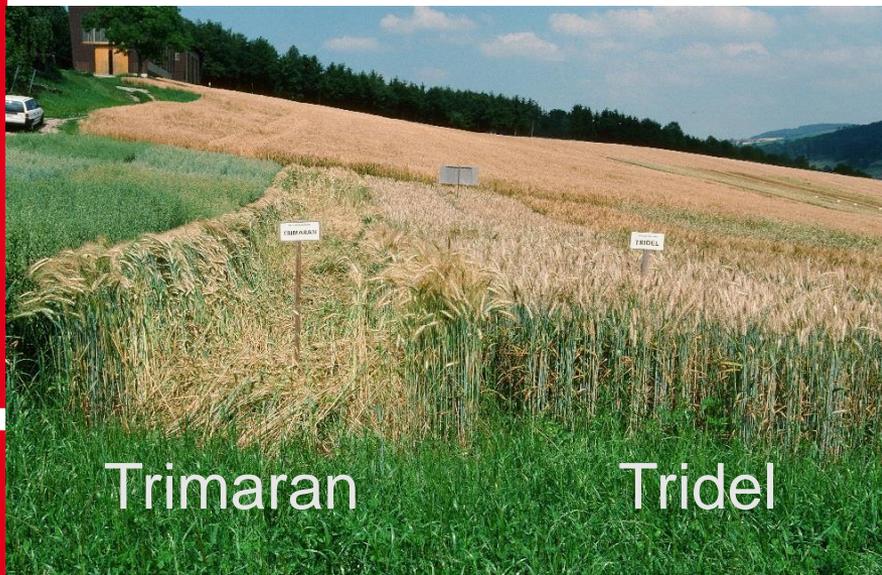
Cultivars

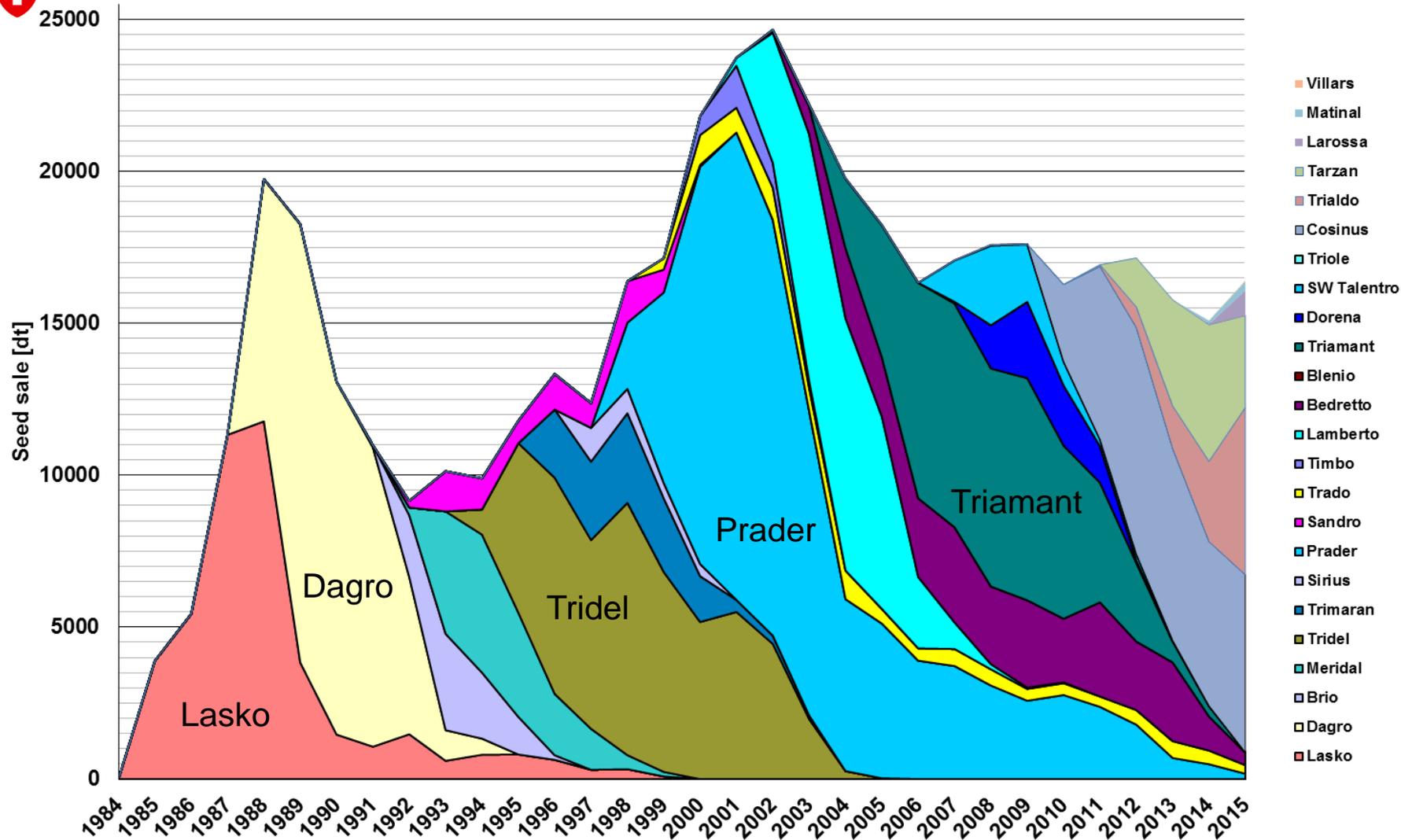
(1)

- 1980 first triticale cultivation in Switzerland (cv. Lasko)

Swiss National List

- | | | |
|--------------------|-------|--------|
| ▪ 1983 cv. Lasko | (POL) | 135 cm |
| ▪ 1987 cv. Dagro | (POL) | 129 cm |
| ▪ 1991 cv. Brio | (CHE) | 116 cm |
| ▪ 1992 cv. Meridal | (CHE) | 115 cm |
| ▪ 1994 cv. Tridel | (CHE) | 101 cm |







Swiss triticale cultivar on the French National List

- 1989 Gaetan co-obt. Orsem
- 1993 Formulin co-obt. Orsem
- 1994 Brio co-obt. DuPont Hybrinova
- 1996 Indiana co-obt. DuPont Hybrinova
- 1997 **Tridel**
- 1998 Imola co-obt. DuPont Hybrinova
- 2001 Timbo
- 2003 Bedretto
- 2003 Blenio



Breeding goal

- By the end of the Eighties, all registered triticale cultivars were tall (135cm to 150cm).
- Our nursery contained several very short lines with the dwarfing gene *Rht3*.
- But these lines, in spite of very fertile spikes, had a low yield, caused by:
 - low tillering
 - bad grain filling
- Since 1987, F1 hybrids were produced by DSP (Delley Seeds and Plants, Ltd) and Agroscope, using chemical hybridising agents (CHA).

The goal was to combine the productivity of tall genotypes with the spike fertility of the shortest genotypes.



Hybrid F1

CHA

(1)

1. CIBA-GEIGY

- Very efficient,
- High male sterility and no (or very low) phytotoxicity

but

- Very expensive,
- Need a large amount of active substance (some kg/ha)
- Not developed for commercial use

its use on triticale was limited to a small experimental scale



Hybrid F1

CHA

(2)

2. Hybrinova – DuPont

- Croisor ® (Sintofen) (now by Saaten-Union)



3. HybriTech - Monsanto

- Genesis ®



- For both CHA, some phytotoxic effect:

- Reducing plant height
- Leaves coloration (red)

or discoloration

- Phytotoxic effect strongly dependent on genotype
- Almost total male sterility





Hybrid F1

CHA

(3)

- CHA applications technics have been improved (phenologic stage, doses, adjuvant, machine)
- Adjuvants have especially been improved for wheat hybrid production (SaatenUnion)



Hybrid triticale F1 | Gumpenstein
D. Fossati



Hybrid F1

CHA

(2)





Hybrid F1

1987 - 1994

- During the first years of experimentation (1987 - 1994), very short lines (with possibly the dwarfing gene Rht3) were combined with taller lines.





Hybrid F1

1987 - 1994

- The F1 hybrids were in general shorter than the mid-parent value. Thousand kernel weight (TKW) was higher. But due to the weak tillering, the yield wasn't improved.
- Specific weight tended to be equivalent to the worst parent. The cytological instability of the *Rht3* gene caused a lack of uniformity in hybrids.
- In conclusion, the negative characters related to this gene were not compensated by the heterosis effect.

Performance of hybrids compared to the mean of both parents, express as difference of relative values (%) to 2 standards

Period		Yield	1000-Kernel Weight	Plant height	Test Weight	Heading
1987 - 1994 n=38	mean	-8.5	8.6	-3.7	-2.3	-0.04
	minimum	-29.4	-7.3	-18.1	-10.5	-1.9
	maximum	30.9	29.3	10.1	5.3	2.5



Hybrid F1 1995 - 1998

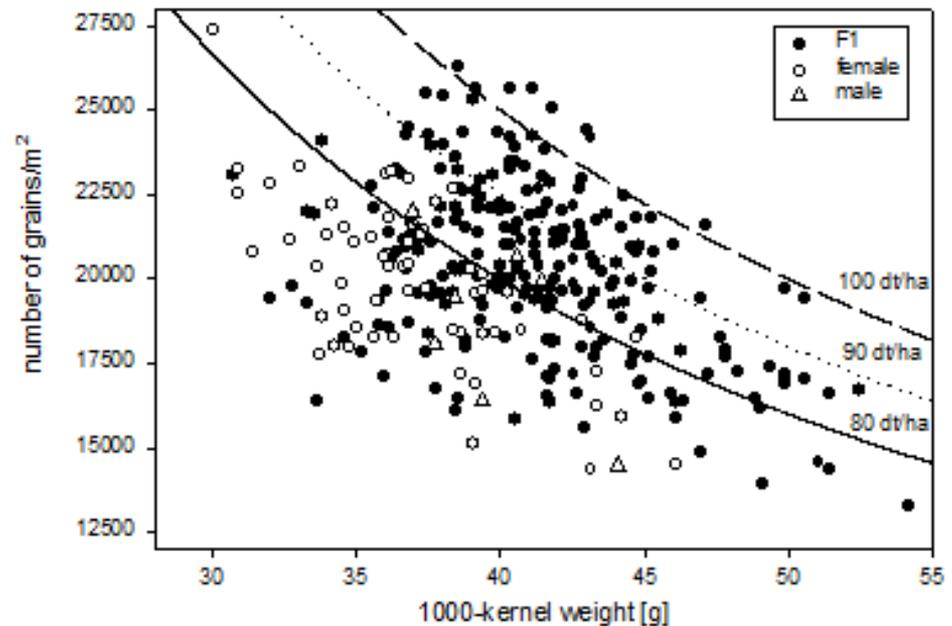
- The following years (1995-1998), genotypes of middle size, such as the cultivar **Tridel**, were combined with tall lines.
- Generally the produced hybrids proved to be pure.
- Triticale hybrids confirmed that the most significant heterosis effect was on grain weight, as observed in wheat hybrids.
- Strong parental influences on grain weight and number of grains per square meter were observed.
- On an average, plant height increased slightly (~5%).
- Yield increased, sometimes in a considerable way.



Hybrid F1 1995 - 1998

Performance of hybrids compared to the mean of both parents, express as difference of relative values (%) to 2 standards

Period		Yield	1000-Kernel Weight	Plant height	Test Weight	Heading
1995 - 1998 n=235	mean	7.5	9.7	5.3	0.30	0.04
	minimum	-28.4	-23.4	-17.5	-6.6	-7.4
	maximum	36.4	45.5	21.4	7.1	8.2





Hybrid F1 1995 - 1998

- Heterosis effect on earliness and specific weight was moderate.
- The average results masked a great variability but the best hybrids were agronomically very promising.
- The highest yielding hybrid exceeded 120 dt/ha.
- One of our hybrids was the highest yielding variety (114% of the standards) in the first year in official French trials.
- After 1996, we produced as well some spring triticale hybrids (results not presented).



Registrations

Swiss National List

- 1998 HYBRIDEL F1 TRIDEL/NELSON
- 1999 DELRAC F1 TRIDEL/51909

Swiss triticale cultivar on the French National List

- 1998 ZOLDER (liste B)
- 1998 KADOR F1 TRIDEL/TRILI-UNO
- 1999 CLINT F1 TRIDEL/ZOLDER
- 1999 TRILI-UNO (liste B)



Hybridel in Germany

Yield Trial, 2001, 5 Locations, 10 cultivars, without fungicide						
Traits	Hybridel	% to mean value	Mean	% to best cultivar	Best cultivar	Best cultivar name
Yield (dt/ha)	91.9	110.7	83.0	106.2	86.5	Lamberto
Protein content (%)	13.1	100.0	13.1	94.9	13.8	Logo
Protein yield (dt/ha)	10.3	109.6	9.4	103.0	10.0	Kitaro
TKW (g)	42.2	103.2	40.9	93.6	45.1	Logo
HLG (kg/hl)	71.4	99.4	71.8	95.6	74.7	Vitalis
Falling number (sec)	173	109.5	158	86.1	201	Osorno
Grain number/spike	39.5	111.9	35.3	105.3	37.5	Osorno

Versuchsbericht, Landessortenversuche Wintertriticale Qualität 2001, Landesanstalt für Landwirtschaft und Gartenbau Sachsen-Anhalt

- Yield, Protein yield and Grain number/spike > best cultivar



Hybrid F1 CHA Results summary

- More than 600 triticale F1 hybrids were produced and tested in yield trials in Switzerland.
- On average, hybrids had
 - a higher 1000 kernel weight (9.7%),
 - a higher yield (7.5%),
 - and a higher plant height (5.3%) **compared to the mid-parent value.**
- Yield of the best hybrid exceeded the mean of both parents by 36.4% (33.1% of the best parent).
- Several hybrids were tested in the official trials of France, Switzerland, Germany and Austria.
- Four F1 hybrids were good enough for registration, two in France and two in Switzerland.



Conclusion

Positive

- Male
 - High anther extrusion & strong pollen production
 - Long flowering time
- Female
 - Shorter type available
- F1
 - Grain/spike
 - TKW
 - Yield,
especially under stress condition (roots)





Conclusion

- Negative
 - Low heterosis on tillering
 - Some doubt about falling number

- Higher seed production cost
for a **forage cereal**
 - a relative low price
 - possible substitution with other forage





Thank you for your attention

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